

CNF: $A \rightarrow BC$ $A, B, C \in V$
 $A \rightarrow x$ $x \in T$

conversion (CFG \rightarrow CNF):
 rules

- pre-procedure:
0. Remove empty string (if exists)
 1. Remove lambda productions
 2. Remove unit productions
 3. Remove useless productions

aside:

int array [25];
 array [2] = 3;

CNF rules:

I. $A \rightarrow x_1 x_2 \dots x_n$

if $n=1$ then $x_1 \in T$ since no unit productions leave alone

if $n \geq 2$ introduce new variable(s) B_{x_i} for $\forall x_i \in T$ and then add P_{x_i} for $B_{x_i} \rightarrow x_i$

II

if productions of form $A \rightarrow a$ or $A \rightarrow BC$, keep.

if $n \geq 2$, then add new variable D_i
 $\Rightarrow D_i \rightarrow BC$ where $B, C \in V$

Δ^+ add back in empty string if removed.

ex Rule 1:

$A \rightarrow a$ ✓

~~$A \rightarrow B$~~

$A \rightarrow BC$ ✓

$A \rightarrow a b \equiv A \rightarrow x_a x_b$

$x_a \rightarrow a$

$x_b \rightarrow b$

$A \rightarrow a a \equiv A \rightarrow x_a x_a$

$x_a \rightarrow a$

$A \rightarrow a B C a \equiv A \rightarrow x_a B C x_a$

$x_a \rightarrow a$ ✓

ex Rule 2:

$A \rightarrow x_a B C x_a \equiv A \rightarrow x_{aB} x_{Ca}$ ✓

$x_{aB} \rightarrow x_a B$ ✓

$x_{Ca} \rightarrow C x_a$ ✓

$A \rightarrow B C D \equiv A \rightarrow x_{BC} D$

$x_{BC} \rightarrow B C$

$\equiv A \rightarrow B x_{CD}$

$x_{CD} \rightarrow C D$

ex 0.

$S \rightarrow a A \mid \lambda$

$A \rightarrow a \mid B$

$B \rightarrow b b a$

1. remove lambda productions = none

$S_0 \rightarrow a A$

$A \rightarrow a \mid B$

$B \rightarrow b b a$

2. remove unit productions

$S_0 \rightarrow a A$

$A \rightarrow a \mid b b$

$B \rightarrow b b a$

3. remove useless productions

$S_0 \rightarrow a A$

$A \rightarrow a \mid b b a$

$S_0 \rightarrow x_a A$

$A \rightarrow a \mid x_b x_b x_a$

$x_a \rightarrow a$

$x_b \rightarrow b$

$S_0 \rightarrow x_a A$

$A \rightarrow x_a \mid b b$

$S_0 \rightarrow x_a A$ ✓

$A \rightarrow a \mid x_{bb} x_a$ ✓

$x_a \rightarrow a$ ✓

$x_b \rightarrow b$ ✓

$x_{bb} \rightarrow x_b x_b$ ✓

~~x_{bb}~~

~~$A \rightarrow x_{bb}$~~

~~$x_{bb} \rightarrow b b$~~

Δ^+

$S \rightarrow S_0 \mid \lambda$

$S_0 \rightarrow x_a A$

$A \rightarrow a \mid x_{bb} x_a$

$x_a \rightarrow a$

$x_b \rightarrow b$

$x_{bb} \rightarrow x_b x_b$

$A \rightarrow a \mid b \mid c$

$\equiv A \rightarrow a$

$A \rightarrow b$

$A \rightarrow c$

int x;

int y;

int z;

vs.

int x, y, z;